**Supplementary file 1**

Supplementary file 1a Comparison between the PM2.5 concentrations simulated by GEOS-Chem model and those estimated from satellite measurements and other inputs. In the comparison, the satellite-based estimates are utilized as the gold-standard referent values and the GEOS-Chem simulations as predictions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean bias (µg/m3) | Root of mean squared error (µg/m3) | Regression of referent against prediction | R2 |
| Intercept  | Slope |
| 2000 | 14.23 | 20.86 | 7.68 | 1.31 | 0.69 |
| 2001 | 12.27 | 17.47 | 6.68 | 1.27 | 0.74 |
| 2002 | 12.59 | 18.90 | 6.43 | 1.28 | 0.73 |
| 2003 | 11.94 | 18.12 | 4.13 | 1.36 | 0.76 |
| 2004 | 11.84 | 19.82 | 5.30 | 1.28 | 0.70 |
| 2005 | 10.03 | 16.16 | 5.99 | 1.18 | 0.72 |
| 2006 | 9.09 | 14.82 | 7.33 | 1.08 | 0.73 |
| 2007 | 9.80 | 15.81 | 6.84 | 1.12 | 0.77 |
| 2008 | 9.61 | 16.58 | 7.44 | 1.08 | 0.77 |
| 2009 | 10.91 | 16.15 | 6.99 | 1.16 | 0.82 |
| 2010 | 10.51 | 16.76 | 6.26 | 1.17 | 0.78 |
| 2011 | 11.61 | 17.46 | 7.67 | 1.14 | 0.82 |
| 2012 | 14.48 | 21.60 | 4.95 | 1.35 | 0.82 |
| 2013 | 11.30 | 17.67 | 5.19 | 1.23 | 0.82 |
| 2014 | 10.30 | 16.61 | 6.86 | 1.13 | 0.80 |
| overall | 11.37 | 17.75 | 6.67 | 1.19 | 0.76 |

Supplementary file 1b Population characteristics.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Group | All samples | low-birthweight births | very-low-birthweight births |
| Categorical variable | N (percentage, %) |
| Total | 227,948 (100) | 31,854 (100) | 2,912 (100) |
| Sex | Male | 114,772 (50.4) | 14,840 (46.6) | 1,379 (47.4) |
| Female | 113,176 (49.6) | 17,014 (53.4) | 1,533 (52.6) |
| Year of birth | 2000 | 1,169 (0.5) | 166 (0.5) | 15 (0.5) |
| 2001 | 4,366 (1.9) | 645 (2.0) | 64 (2.2) |
| 2002 | 5,837 (2.6) | 777 (2.4) | 90 (3.1) |
| 2003 | 7,853 (3.4) | 959 (3.0) | 97 (3.3) |
| 2004 | 9,729 (4.3) | 1,055 (3.3) | 114 (3.9) |
| 2005 | 10,091 (4.4) | 1,136 (3.6) | 113 (3.9) |
| 2006 | 13,222 (5.8) | 1,514 (4.8) | 120 (4.1) |
| 2007 | 13,806 (6.1) | 1,697 (5.3) | 164 (5.6) |
| 2008 | 15,324 (6.7) | 1,903 (6.0) | 153 (5.3) |
| 2009 | 18,004 (7.9) | 2,034 (6.4) | 183 (6.3) |
| 2010 | 25,159 (11.0) | 3,305 (10.4) | 295 (10.1) |
| 2011 | 29,397 (12.9) | 4,537 (14.2) | 391 (13.4) |
| 2012 | 27,284 (12.0) | 4,352 (13.7) | 397 (13.6) |
| 2013 | 23,015 (10.1) | 3,920 (12.3) | 388 (13.3) |
| 2014 | 23,692 (10.4) | 3,854 (12.1) | 328 (11.3) |
| Singleton (n = 1) or multiple births (n > 1) | n = 1 | 211,276 (92.7) | 23,910 (75.1) | 1,740 (59.8) |
| n = 2 | 8,268 (3.6) | 3,876 (12.2) | 552 (19.0) |
| n = 3 | 8,276 (3.6) | 3,962 (12.4) | 573 (19.7) |
| n = 4 | 124 (0.1) | 102 (0.3) | 45 (1.5) |
| n = 5 | 4 (0.0) | 4 (0.0) | 2 (0.1) |
| Region | East Asia & Pacific | 10,059 (4.4) | 1,259 (4.0) | 173 (5.9) |
| Latin America & Caribbean | 25,747 (11.3) | 3,040 (9.5) | 372 (12.8) |
| North Africa, Europe & Central Asia | 21,932 (9.6) | 2,948 (9.3) | 404 (13.9) |
| South Asia | 57,004 (25.0) | 11,307 (35.5) | 981 (33.7) |
| Sub-Saharan Africa | 113,206 (49.7) | 13,300 (41.8) | 982 (33.7) |
| Recall period (years, from birthdate to survey date) | < 0.5 | 22,628 (9.9) | 2,586 (8.1) | 218 (7.5) |
| 0.5~1.5 | 40,984 (18.0) | 5,421 (17.0) | 496 (17.0) |
| 1.5~2.5 | 48,707 (21.4) | 7,258 (22.8) | 674 (23.1) |
| 2.5~3.5 | 40,755 (17.9) | 6,086 (19.1) | 600 (20.6) |
| 3.5~4.5 | 52,658 (23.1) | 7,442 (23.4) | 647 (22.2) |
| 4.5~5 | 22,216 (9.7) | 3,061 (9.6) | 277 (9.5) |
| Birth order | 1 | 47,969 (21.0) | 7,737 (24.3) | 767 (26.3) |
| 2 | 70,468 (30.9) | 9,765 (30.7) | 864 (29.7) |
| 3 | 41,015 (18.0) | 5,467 (17.2) | 477 (16.4) |
| 4 | 25,521 (11.2) | 3,324 (10.4) | 302 (10.4) |
| 5 | 16,517 (7.2) | 2,103 (6.6) | 190 (6.5) |
| 6 | 10,813 (4.7) | 1,406 (4.4) | 132 (4.5) |
| 7 | 15,645 (6.9) | 2,052 (6.4) | 180 (6.2) |
| Maternal age | < 16 | 1,712 (0.8) | 315 (1.0) | 41 (1.4) |
| 16~20 | 43,166 (18.9) | 6,895 (21.6) | 650 (22.3) |
| 21~25 | 82,870 (36.4) | 11,666 (36.6) | 1,056 (36.3) |
| 26~30 | 56,738 (24.9) | 7,317 (23.0) | 628 (21.6) |
| 31~35 | 28,694 (12.6) | 3,591 (11.3) | 345 (11.8) |
| 36~40 | 12,210 (5.4) | 1,706 (5.4) | 163 (5.6) |
| > 40 | 2,558 (1.1) | 364 (1.1) | 29 (1.0) |
| Residence | Rural | 142,202 (62.4) | 20,396 (64.0) | 1,740 (59.8) |
| Urban | 85,746 (37.6) | 11,458 (36.0) | 1,172 (40.2) |
| Education | No education | 52,061 (22.8) | 8,436 (26.5) | 691 (23.7) |
| Primary | 74,510 (32.7) | 9,476 (29.7) | 855 (29.4) |
| Secondary | 82,914 (36.4) | 11,600 (36.4) | 1,110 (38.1) |
| Higher | 18,455 (8.1) | 2,340 (7.3) | 256 (8.8) |
| Unknown | 8 (0.0) | 2 (0.0) | 0 |
| Head of household | Female | 37,259 (16.3) | 5,309 (16.7) | 499 (17.1) |
| Male | 190,689 (83.7) | 26,545 (83.3) | 2,413 (82.9) |
| Wealth level | Richest | 41,464 (18.2) | 4,948 (15.5) | 471 (16.2) |
| Richer | 45,145 (19.8) | 6,091 (19.1) | 567 (19.5) |
| Middle | 47,235 (20.7) | 6,567 (20.6) | 591 (20.3) |
| Poorer | 47,539 (20.9) | 6,920 (21.7) | 609 (20.9) |
| Poorest | 46,231 (20.3) | 7,224 (22.7) | 661 (22.7) |
| Unknown | 334 (0.1) | 104 (0.3) | 13 (0.4) |
| Type of cooking energy | Unclean | 160,760 (70.5) | 21,897 (68.7) | 1,780 (61.1) |
| Clean | 53,348 (23.4) | 7,713 (24.2) | 869 (29.8) |
| Unknown | 13,840 (6.1) | 2,244 (7.0) | 263 (9.0) |
| Body mass index level | Underweight | 20,756 (9.1) | 4,154 (13.0) | 327 (11.2) |
| Normal | 97,169 (42.6) | 13,863 (43.5) | 1,164 (40.0) |
| Overweight | 32,759 (14.4) | 4,006 (12.6) | 397 (13.6) |
| Obese | 14,265 (6.3) | 1,776 (5.6) | 224 (7.7) |
| Unknown | 62,999 (27.6) | 8,055 (25.3) | 800 (27.5) |
| Smoking | No | 206,937 (90.8) | 28,629 (89.9) | 2,599 (89.3) |
| Yes | 9,105 (4.0) | 1,470 (4.6) | 132 (4.5) |
| Unknown | 11,906 (5.2) | 1,755 (5.5) | 181 (6.2) |
| Unemployed mother | No | 102,861 (45.1) | 11,874 (37.3) | 1,056 (36.3) |
| Yes | 76,781 (33.7) | 10,501 (33.0) | 1,067 (36.6) |
| Unknown | 48,306 (21.2) | 9,479 (29.8) | 789 (27.1) |
| Continuous variable | Mean (standard deviation) |
| Birthweight (g) | 3081.91 (724.11) | 1962.22 (368.99) | 1092.79 (222.60) |
| Fire-sourced PM2.5 (µg/m3) | 4.29 (5.53) | 3.35 (4.65) | 2.64 (3.86) |
| Non-fire-sourced PM2.5 (µg/m3) | 37.43 (29.60) | 42.03 (31.90) | 40.99 (32.61) |
| Temperature (K) | 296.38 (4.78) | 296.90 (4.37) | 296.78 (4.26) |
| Humidity (g/kg) | 12.36 (3.51) | 12.18 (3.40) | 12.00 (3.56) |
| Maternal age (year) | 25.52 (5.71) | 25.13 (5.79) | 25.05 (5.89) |
| Number of matched siblings | 2.13 (0.36) | 2.18 (0.43) | 2.26 (0.53) |